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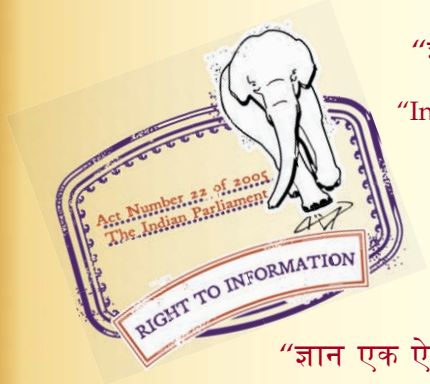
IS 10805 (1986): Foot valves, reflux valves or non-return valves and bore valves to be used in suction lines of agricultural pumping systems [MED 20: Pumps]



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"Knowledge is such a treasure which cannot be stolen"

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IS : 10805 - 1986
(Reaffirmed 2007)
Edition 2.3
UDC 621.646.2 : 621.671 : 631.348.45 **(2002-11)**

Indian Standard

SPECIFICATION FOR FOOT-VALVES, REFLUX VALVES OR NON-RETURN VALVES AND BORE VALVES TO BE USED IN SUCTION LINES OF AGRICULTURAL PUMPING SYSTEMS

(First Revision)

(Incorporating Amendment Nos. 1, 2 & 3)

Pumps Sectional Committee, EDC 35; Horizontal Spindle Pumps Subcommittee, EDC 35 : 2 [Ref : Doc : EDC 35 (4592)]

1. Scope — Covers the requirements for screwed and flanged foot-valves, reflux valves or non-return valves and bore valves to be used in suction lines of centrifugal pumps for agricultural purposes.

2. Dimensions — The dimensions of the valves shall be as given in Table 1.

2.1 Typical drawings of foot-valve, reflux valve and bore valve are given in Fig. 1 to 3.

TABLE 1 DIMENSIONS OF FOOT-VALVES, REFLUX VALVES AND BORE VALVES

(*Clause* 2)

All dimensions in millimetres.

Nominal Size	Openings in Strainer		Screwed End		Face to Face Dimension (± 2 mm)
	Holes Maximum Diameter	Slots Maximum Width	Minimum Height of Flat End	Minimum Length of Threaded Portion	
25	6	6	10	15	—
32	7	7	10	15	—
40	8	8	10	15	—
50	10	10	12	15	256
65	12	12	15	20	260
80	12	12	18	22	274
100	15	15	22	26	304
125	15	15	26	26	338
150	15	15	26	26	394

Notes

1 In reflux valves the threaded or flanged connection is provided in place of strainer unit. Thus, a reflux valve shall have screwed ends or flanged ends at top and bottom portion. It may be screwed at one end and flanged at one end also. Return valve may have following alternate end connection:

a) both end screwed;
b) both end flanged;
c) bottom end flanged, top end screwed; and
d) bottom end screwed, top end flanged.

Dimensions of such screwed/flanged ends shall be as indicated in the table.

2 In bore valves the top ends shall have screwed ends. The dimensions of screwed ends shall be as indicated above. The outside diameter of entire bore valve shall be smaller (by more than 5 mm) than the internal diameter of bore pipe in which it is to be inserted. Bore valve may or may not have strainer.

3 The opening in the strainers may be in the form of hole or slots or combination of both.

4 Where required, an access window may be provided for carrying out maintenance.

5 The face to face dimensions are applicable only for valves, where both ends of the valve are of flanged construction, as shown in Fig. 2B.

3. Materials

3.1 It is recognized that a number of materials of construction are available. A few typical materials are indicated below for the guidance of the manufacturers and the users:

Sl No.	*Component*	*Material*
i)	Housing, seat and strainer	Cast iron of Grade FG 150 of IS 210-1978 'Specification for grey iron castings (*third revision*)'
ii)	Disc and disc plate	a) Cast Iron of Grade FG 150 of IS : 210-1978

Adopted 12 March 1986 **Price Group 4**

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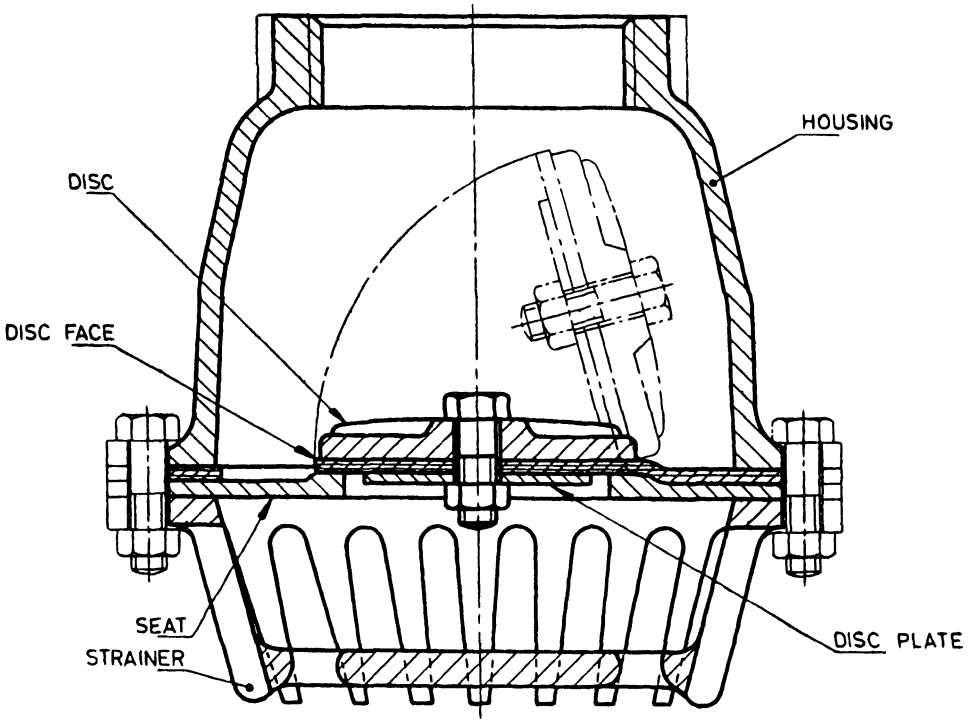


Note — Shape of foot valve has been given only to illustrate the nomenclature and is not intended to limit the design.

FIG. 1 FOOT-VALVE

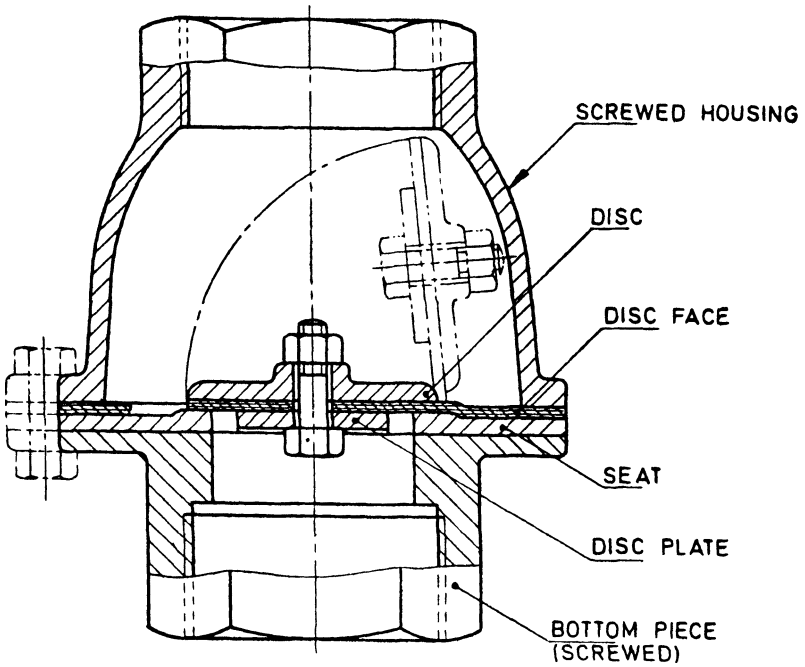


FIG. 2A TYPICAL SECTIONAL DRAWING OF SCREWED REFLUX VALVE TO BE USED IN SUCTION LINE OF AGRICULTURAL PUMP

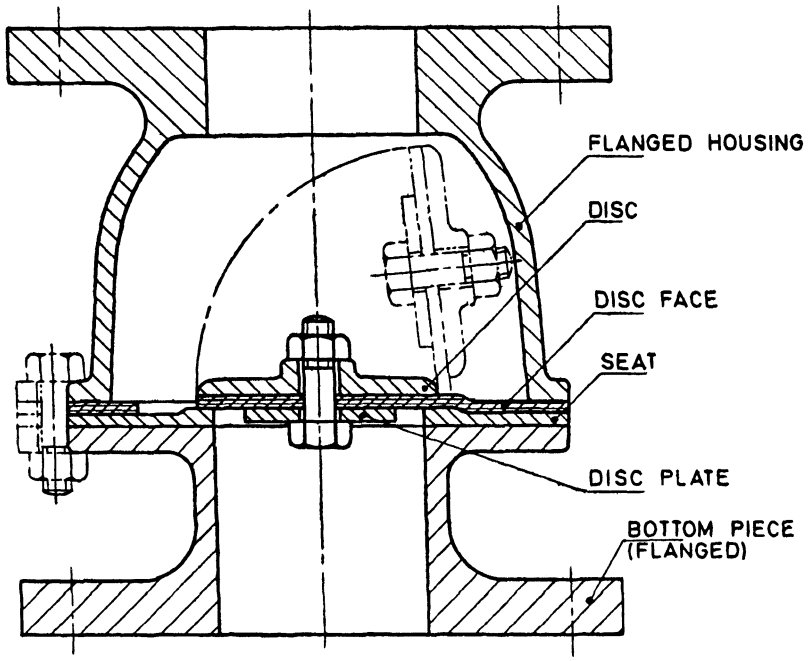


FIG. 2B TYPICAL SECTIONAL DRAWING OF FLANGED REFLUX VALVE TO BE USED IN SUCTION LINE OF AGRICULTURAL PUMP

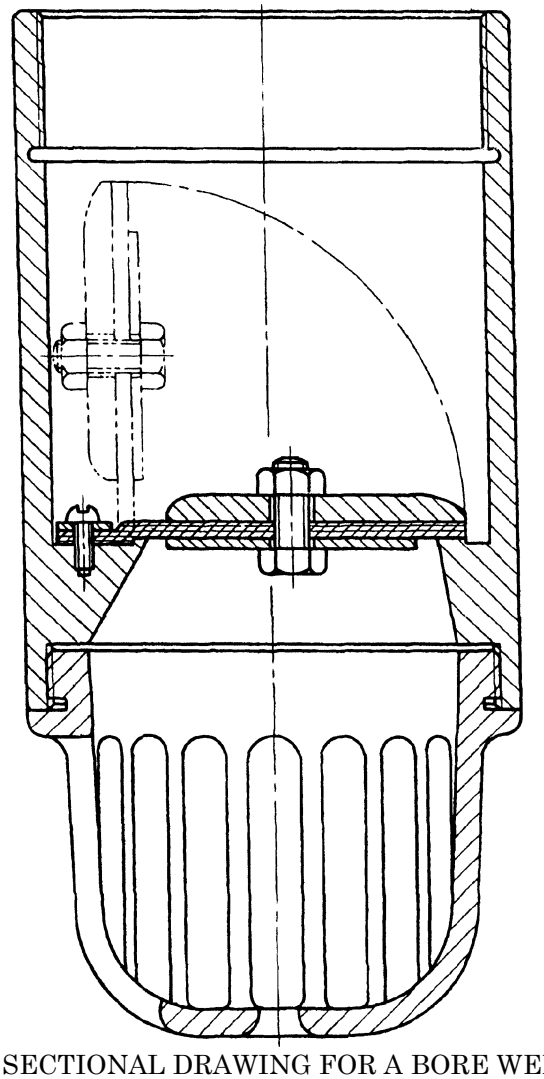


FIG. 3 TYPICAL SECTIONAL DRAWING FOR A BORE WELL FOOT-VALVE

Sl No.	*Component*	*Material*
		b) Mild steel conforming to Grade St 34 of IS : 1079-1973 'Specification for hot rolled carbon steel sheet and strip (*third revision*)'
iii)	Disc face (flap)	a) Vegetable tanned leather
		b) Natural rubber with or without reinforcement of cotton canvas
		c) Synthetic rubber with or without reinforcement of cotton canvas

3.2 Besides these materials, plastics like rigid PVC, high density polyethylene and polypropelene are also suitable materials for manufacture of foot-valves, reflux valves and bore valves.

4. Requirements

4.1 The friction loss in a foot-valve, reflux valve or bore valve shall be defined as:

$$hf = \frac{KV^2}{2g}$$

where

hf = frictional losses in the valve (meters of water column),
K = friction coefficient of the valve,
V = velocity of flow of water in the suction or bore pipe of diameter corresponding to the nominal size of valve (m/s), and
g = acceleration due to gravity (m/s^2).

4.1.1 The designs of the foot-valves and reflux valves shall be such that the K-value shall not exceed the value given below in the entire range of discharge indicated in Table 2.

Valve Type	K
Foot valve	0.8
Reflux valve	0.5
Bore valve with strainer	1.4
Bore valve without strainer	1.2

4.1.2 The K value for bore valve shall be as given in **4.1.1**.

4.1.2.1 Range of discharge shall be as given in Table 2.

TABLE 2 RANGE OF DISCHARGE FOR DIFFERENT SIZES OF VALVES

(*Clauses* 4.1.1, 4.1.2.1 *and* 6.2.1)

Nominal Size of Valve in mm	**Range of Discharge** l/s
25	0.3 to 2.2
32	1.2 to 3.5
40	1.5 to 5
50	3 to 7
65	5 to 12
80	8 to 20
100	16 to 32
125	25 to 53
150	40 to 84

4.2 *Screwed Ends* — The ends shall have internal threads conforming to IS : 554-1985 'Dimensions for pipe threads where pressure tight joints are required on the threads (*third revision*)'.

4.3 The dimensions of flanges and diameter of bolt holes shall be as given in Table 3 unless otherwise required for export.

Note — Considering that large number of flanges are being manufactured having PCD and outer dia D at variance with those given in Table 3, these dimensions may also be as agreed between manufacturer and purchaser. However efforts should be made to switch over to dimensions given in Table 3 to facilitate interchangeability.

5. Coating

5.1 Two coats of black japan conforming to Type B of IS : 341-1971 'Specification for black japan, Types A, B and C (*first revision*)' or paint conforming to IS : 158-1968 'Specification for ready mixed paint, brushing brtuminous, black, lead free, acid, alkali and heat resisting (*third revision*)' shall be applied.

6. Testing

6.1 *Tests*

6.1.1 *Seat test* — Each valve shall be held in an upright position and seat shall be subjected to maximum hydrostatic test pressure of 0.02 MPa for 2 minutes during which period there shall be no leakage. Alternatively, column pipe of maximum 2 metre length may be used for this test.

6.1.2 *Housing test* — Each valve shall be held in upright position and case part shall be subjected to a hydrostatic pressure of 0.5 MPa for 2 minutes. There shall be neither any leakage nor permanent distortion of any of the component parts.

6.2 *K-Value Test for Foot-Valves and Bore Valves*

6.2.1 The testing set up for determining of K-value of foot valves and bore valves is given in Fig. 4. The water level shall be at or about the tapping connection of manometer during the test. In case water level is above the manometer tapping, the height of water level above manometer tapping (X) shall not exceed 0.1 m. The discharge valve shall be operated from fully close to fully open position to vary the discharge rate (Q), the manometer reading (h_m) and the height of water level above manometer tapping (X) shall be recorded. Five observations shall be taken covering the discharge range specified in Table 2, for the valve under test. The value for h_{ml}, for each observation shall be computed as given below:

$$h_{ml} = h_m + X \qquad \text{.....(1)}$$

where

h_m = manometer reading, and

X = height of water level above manometer tapping.

Graph Q versus h_{ml} shall be plotted. Actual inside diameter of suction pipe used for testing shall be recorded.

The value of K can be worked out for any discharge rate as below:

$$h_{ml} = h_f + h_{fl}\ \frac{V_p^2}{2g} \qquad \text{.....(2)}$$

where

h_{ml} = $h_m + X$,

h_f = friction losses in foot valve = $K\ \frac{V_n^2}{2g}$,

h_{fl} = friction losses in $4d$ length of pipe (that is, pipe length between foot valve and manometer tapping),

V_p = velocity in suction pipe corresponding to actual pipe size used for testing in m/s, and

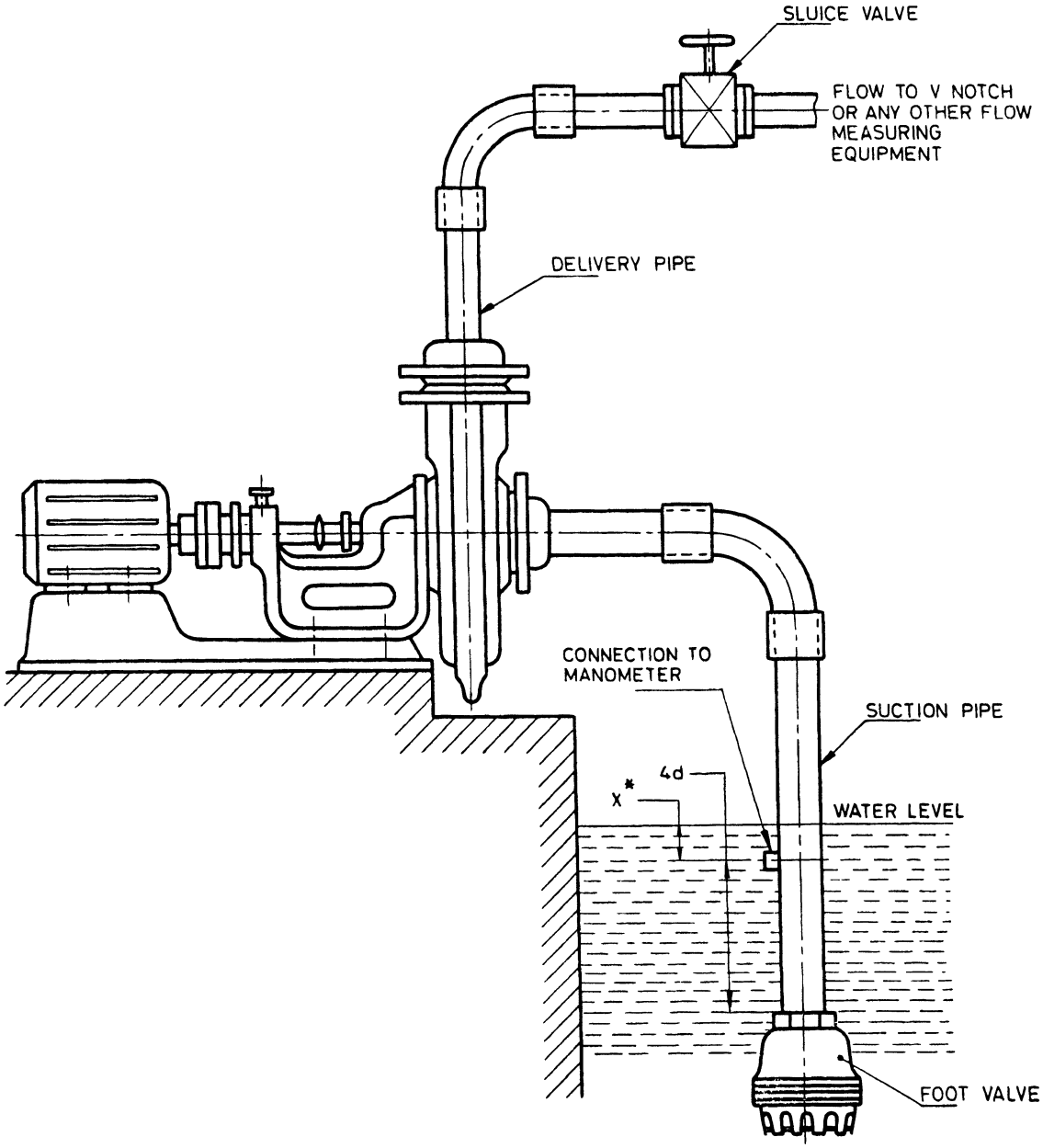
h_{fl} = works out to approximately $0.1\ \frac{V_p^2}{2g}$ for GI pipe.

Hence equation (2) can be put as:

$$h_{ml} = h_f + 1.1\ \frac{V_p^2}{2g} \qquad \text{.....(3)}$$

Compute h_f from equation (3)

$$h_f = K\ \frac{V_n^2}{2g} \qquad \text{.....(4)}$$



d = Inside pipe diameter.
*Value of X shall not exceed 0.1 m.

FIG. 4 SET UP FOR EVALUATING VALUE OF 'K' OF FOOT-VALVE OR BORE VALVE

Value of K can be derived from equation (4).

Example — To work out the value of K for a 100 mm foot valve. From observation

Discharge rate Q = 25 l/s

Manometer reading h_m = 0.7 m of water column

Height of water level above manometer tapping X = 0.1 m

$h_{ml} = h_m + X = 0.7 + 0.1 = 0.8$ m

Actual inside dia of pipe used for testing = 104 mm

Then, $\frac{V_p^2}{2g} = 0.442$ m

$$h_{ml} = h_f + 1.1 \times \frac{V_p^2}{2g}$$

$$0.8 = h_f + 1.1 \times 0.442$$

For 100 mm pipe at $Q = 25$ l/s

$$\frac{V_n^2}{2g} = 0.517 \text{ m}$$

$$h_f = K\frac{V_n^2}{2g}$$

$$0.314 = K \times 0.517$$

$$K = 0.607$$

6.2.2 *K-value tests for reflux valves* — The testing set up for determination of *K*-values of reflux valves shall be as shown in Fig. 5. Water level shall always be maintained below lower tapping of manometer. The test procedure shall be similar to that prescribed in **6.2.1** with the following modifications:

a) There shall be tappings on pipes connected to both the ends of foot-valves at distance of 4 *d* above and below the valve.

b) The pressure difference between those tappings in the pipes connected to the valve shall be measured at different rates of discharge in prescribed range. They shall indicate *hf* in valve + pipe sections.

c) The *hf* in reflux valve shall be computed as follows:

$$hm = h + hf + 0.2\ \frac{V_p^2}{2g}$$

where

hm = manometer reading

$0.2\ \frac{V_p^2}{2g}$ = friction losses in 8*d* length of pipe

hf = friction losses in reflux valve, in metre

6.2.3 *Alternate manometer arrangements for testing 'K' factor for reflux valves*

6.2.3.1 Single differential manometer as shown in Fig. 6 or two differential manometer as shown in Fig. 7 may be used. It shall be ensured that there is no water column into the limbs of the manometers. To avoid entry of water in manometer limbs always test the valve from low discharge rate towards high discharge rate. For these manometer arrangements h_f in reflux valve shall be computed as follows:

$$h_m = h + h_f + 0.2\ \frac{V_p^2}{2g}$$

where

h_m = manometer reading,

$0.2\ \frac{V_p^2}{2g}$ = frictional losses in 8 *d* length of pipe,

V_p = velocity in suction pipe corresponding to actual pipe size used for testing (m/s), and

h_f = frictional losses in reflux valve in mwc. (metre).

6.2.3.2 Inverted *U* tube manometer arrangement may be used as shown in Fig. 8.

Following procedure shall be followed while using this arrangement:

1. 1.1 Keep the cock position so as 1 and 2 are connected.

   1.2 Prime the pump by filling the water.

   1.3 After priming, cock position to be shifted to connect 2 and 3 to release compressed air in the tube connected to the suction of the pump.

   1.4 In case pump is primed by vacuum pump, keep the cock closed from all the three positions and then prime the pump. After priming, cock position as per 1.1 and 1.3 to be kept simultaneously to release air in the tubes.

2. 2.1 Close the cock from all the three positions and start the pump.

   2.2 Open the cock to connect 1 and 3. As the cock is opened the pump suction will cause water rise in the limbs.

2.3 When water level in one limb is visible slightly, close the cock and stop the same when water level in second limb also becomes visible.

3. The height difference between the levels of water in the two limbs shall the value of h_m in mwc. (metre).

A manometer of 1.5 m height may be sufficient for most of the valves.

For this arrangement friction losses in reflux valve shall be computed as follows:

$$h_m = h_f + 0.2 \frac{V_p^2}{2g}$$

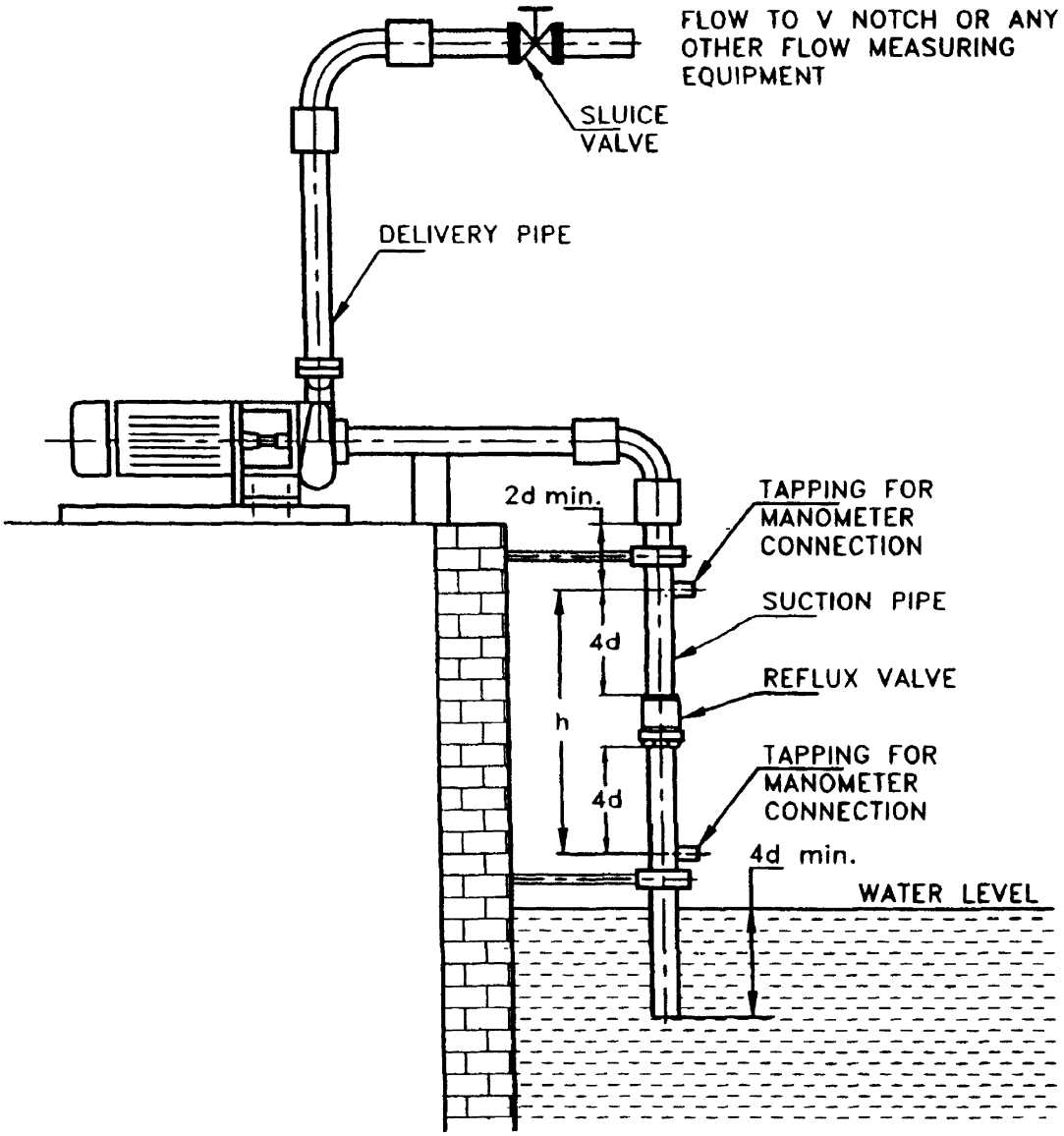
In this arrangement h will not appear in the formula.

6.2.4 Friction of coefficient K at different flow rate shall be computed as follows:

$$h_f = K \frac{V_n^2}{2g}$$

where

V_n = Velocity of flow of water corresponding to nominal size of valve (m/s).



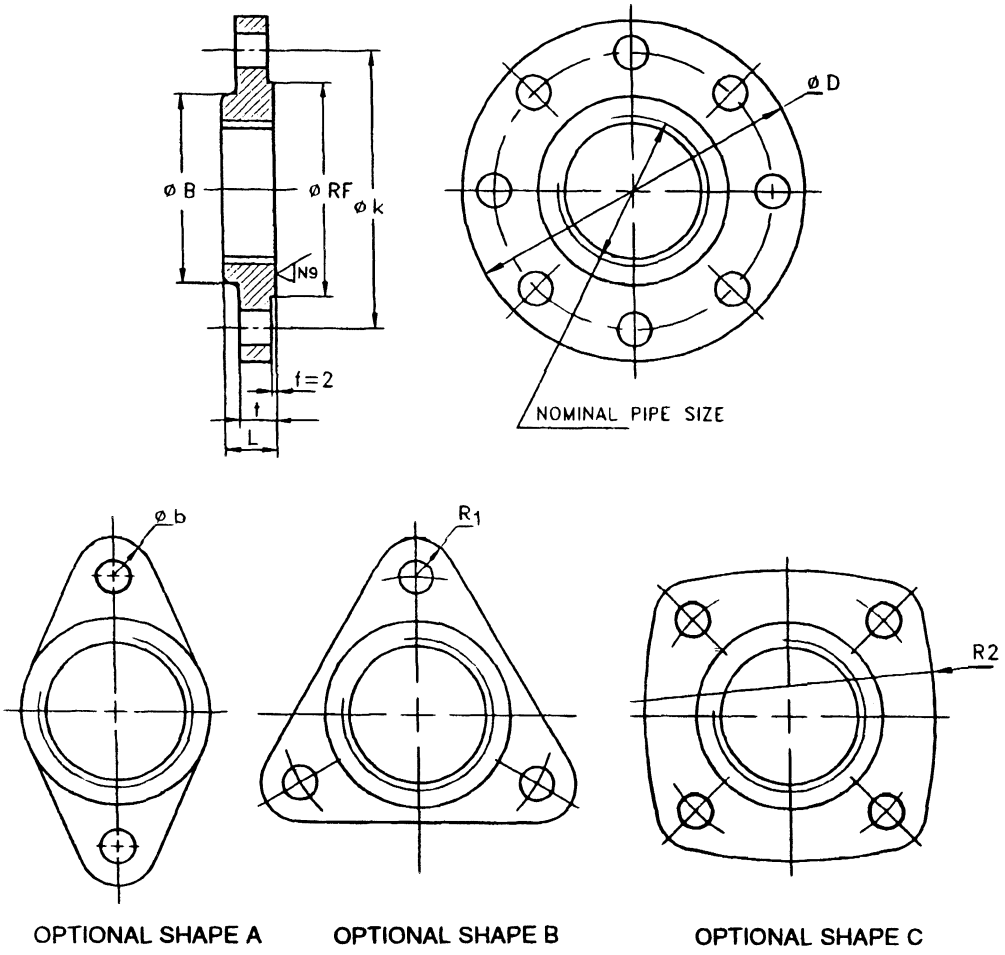
d = Inside pipe diameter.

Note — Refer Fig. 6 and 7 for alternate manometer arrangements.

FIG. 5 TEST SET UP FOR EVALUATING VALUE OF K OF REFLUX VALVE

TABLE 3 DIMENSIONS OF FLANGES

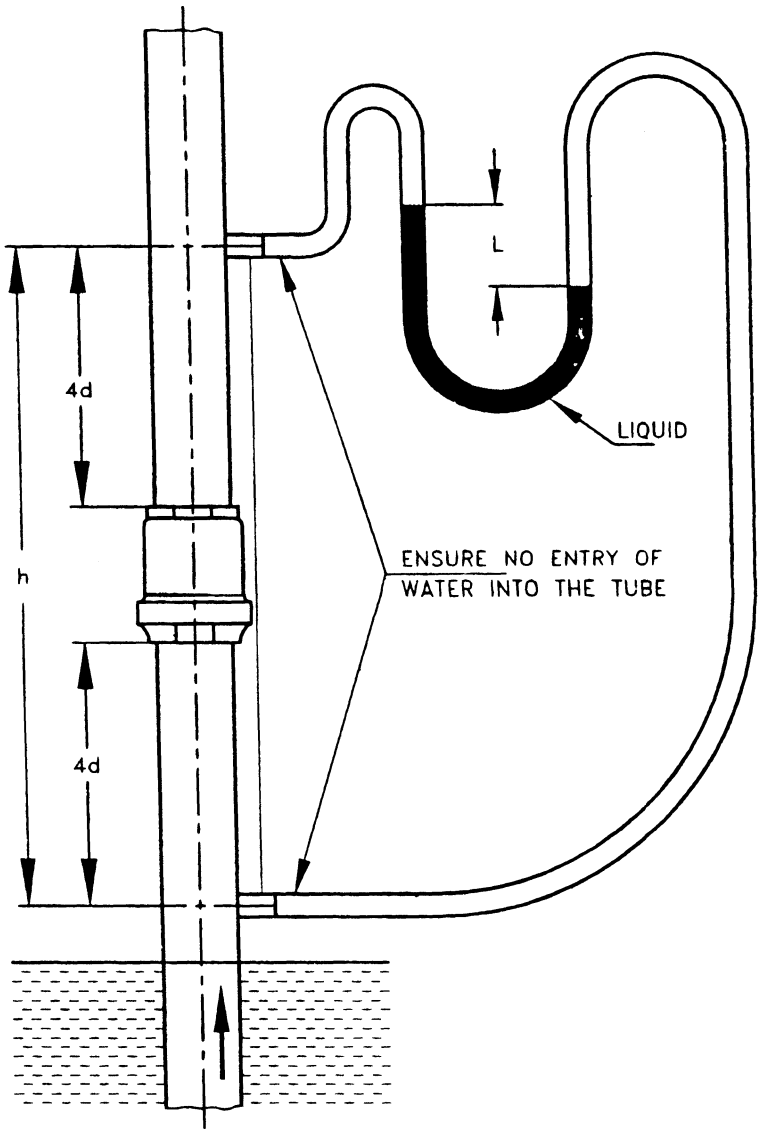
(*Clause* 4.3)



All dimensions in millimetres.

Nominal Pipe Size	Nominal Hub Dia *B*	Nominal Bolt Size	Bolt Nos Off	Dia of Bolt Holes *b*	PCD *k* (± 1)	Nominal Raised Face Dia *RF*	Flange Thick-ness *t, Min*	Thread Length *L, Min*	Outer Dia *D* (± 3)	Optional Shape		
										Type	R_1	R_2
25	46	M 10	2	12	75	60	9	12	100	A	12	—
32	55	M 10	2	12	85	70	9	12	110	A	12	—
40	60	M 10	4	12	95	80	9	12	120	C	12	129
50	71	M 12	4	15	110	95	9	15	140	C	14	168
65	87	M 12	4	15	125	110	11	20	155	C	14	212
80	100	M 12	4	15	140	120	13	22	170	C	14	262
100	130	M 12	4	15	170	145	16	26	200	C	14	378
125	156	M 16	4	19	200	175	16	26	235	—	—	—
150	184	M 16	8	19	225	200	16	26	260	—	—	—

Note — Instead of a distinct flange, the valves may have stud-bolted ends, with studs screwed into tapped holes.



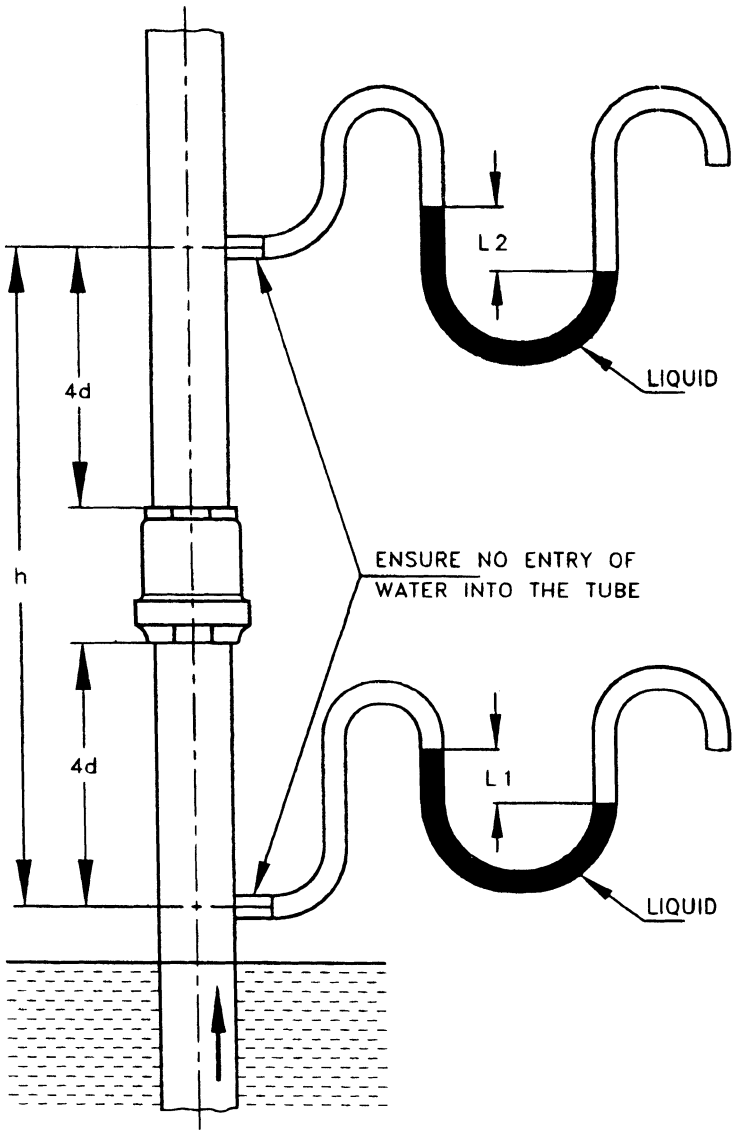
$$h_m = L \times W$$

W = Specific weight of the liquid.

The h_f in Reflux Valve shall be computed as follows:

$$h_m = h + h_f + 0.2 \frac{V_p^2}{2g}$$

FIG. 6 TYPICAL TESTING ARRANGEMENT WITH SINGLE DIFFERENTIAL MANOMETER



$$h_m = (L_2 - L_1) \times W$$

W = Specific weight of the liquid.

The h_f in Reflux Valve shall be computed as follows:

$$h_m = h + h_f + 0.2 \frac{V_p^2}{2g}$$

FIG. 7 TYPICAL TESTING ARRANGEMENT WITH TWO DIFFERENTIAL MANOMETER

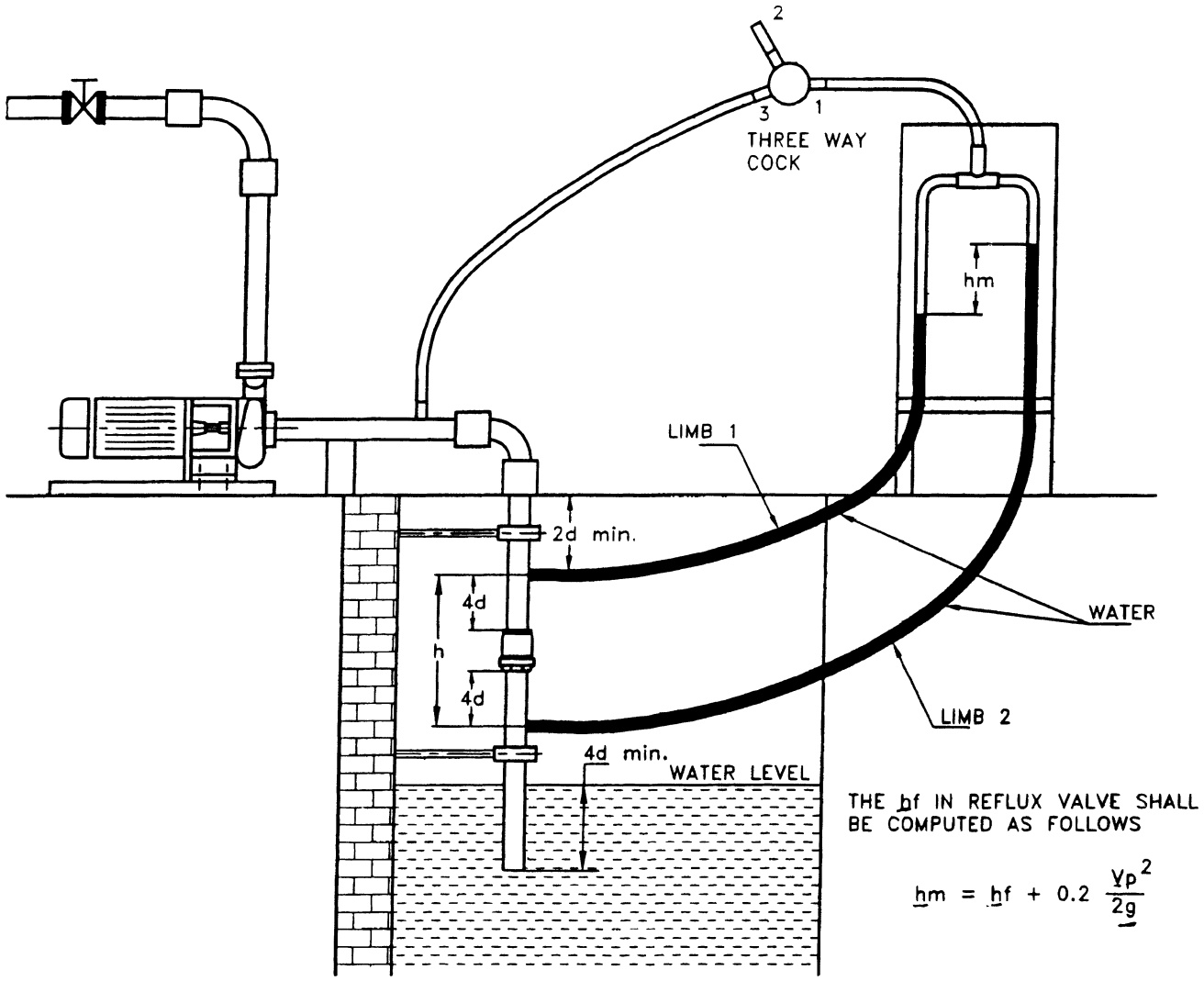


FIG. 8 TYPICAL TESTING ARRANGEMENT WITH INVERTED U TUBE MANOMETER

7. Sampling — One valve out of a lot of 50 to 500 valves of the same size and type shall be randomly picked up for *hf* test. The *K*-values shall be computed from test data. If the *K*-value exceeds prescribed limit at any rate of discharge in specific range for that size, the whole lot shall be rejected.

8. Marking — Every valve shall have cast-mark giving the following information:

a) Manufacturer's name or trade-mark, and

b) Size of the valve.

8.1 *ISI Certification Marking* — Details available with the Indian Standards Institution.

EXPLANATORY NOTE

This standard was first published in 1984, and had covered only the requirements of foot-valve. In this revision the requirements of reflux and bore valves have also been added.

The foot-valve is fitted at the bottom end of suction line which is suspended in the well. It has a strainer unit at bottom portion.

The bore valve is also fitted at bottom end of suction line which is inserted into the bore pipe of dug-cum-bored well or tubewell. It may or may not have a strainer unit at bottom. The outside diameter of the slender body of bore valve is restricted according to the size of bore/tubewell in which it is to be inserted.

The reflux valve is fitted at top end of suction line or bore pipe. Alternatively it may be fitted anywhere in the suction line of which the bottom end is inserted into bore pipe or tubewell. It has threaded or flanged portions at both the ends.

This edition 2.3 incorporates Amendment No. 1 (February 1997), Amendment No. 2 (December 2000) and Amendment No. 3 (November 2002). Side bar indicates modification of the text as the result of incorporation of the amendments.